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0300 PATENT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Nguyen et al.

Attorney Docket No.: NSC1P131X1

Application No.: 10/080,913

Examiner: Not Yet Assigned

Filed: February 21, 2002

Group: Unknown

Title: METHOD AND APPARATUS FOR  
FORMING AN UNDERFILL ADHESIVE LAYER

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail to: Commissioner for Patents, Washington, DC 20231 on March 25, 2002.

Signed: \_\_\_\_\_

Laura M. Dean

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Before examination of the subject patent application, please amend the above-identified patent application as follows:

**In the Specification:**

Please **replace** original paragraph [0007] with the following **amended** paragraph [0007]:

To achieve the foregoing and other objects and in accordance with the purpose of the present invention, an apparatus and method for forming a layer of underfill adhesive on an integrated circuit in wafer form is disclosed. In one embodiment, the layer of underfill adhesive is disposed and partially cured on the active surface of the wafer. Once the underfill adhesive has been partially cured, the wafer is singulated. The individual integrated circuits or die are then mounted onto a substrate such as a printed circuit board. When the solder balls of the integrated circuit are reflowed to form joints with corresponding contact pads on the substrate, the underfill adhesive is completely cured. In an alternative embodiment, the underfill adhesive is fully cured after it is disposed onto the active surface of the wafer. In various other embodiments, the underflow adhesive is disposed onto the wafer using stencil printing, screen printing, molding, or

a spin on deposition process. The underflow adhesive is selected from a group of materials including, but not limited to, epoxies, poly-imides, or silicone-polyimides copolymers and includes one or more of the following components: epoxy resin, a hardener, a catalyst initiator, a coloring dye and an inorganic filler.

Please **replace** original paragrph [0011] with the following **amended** paragraph [0011]:

In the initial step as illustrated in Figure 2(a), a number of underbump metallization pads 110 are formed on the surface of the die 102. The underbump metallization pads 110 may be formed by a number of conventional processes. For example, a layer of solder or other conductive metal is applied on the surface of the die 102. The surface is then masked and etched, leaving the pads 110. In the next step as illustrated in Figure 2(b), solder paste islands 112 are formed on the pads 110. After the solder paste islands 112 are in place, corresponding solder balls 106 are formed by heating the wafer 100 causing the solder to reflow forming the solder balls 106. The resulting structure is illustrated in Figure 2(c). The underbump metallization pad 110 also provides a barrier metal between the solder ball 106 and the interconnects within flip chip die 102.

**In the Claims:**

28. The apparatus of claim 19, wherein the layer of underfill adhesive formed on the active surface of the flip chip integrated circuit has a height less than the height of the solder bumps.

**In the Drawings:**

The Applicants request that the attached Figures 5(a) and 5(b) be added to the application. These figures were inadvertently not included when the application was filed. A review of Figures 5(a) and 5(b) indicates that all of the elements except dam 140 are previously described and illustrated in the specification as filed. The dam 140, however, is fully described in paragraph [0029] of the specification. Therefore, the figures do not add any new matter.

Respectfully submitted,  
BEYER WEAVER & THOMAS, LLP

James W. Rose  
g. No. 34,239

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## MARKED UP VERSION OF AMENDED SPECIFICATION AND CLAIMS

Please **replace** original paragraph [0007] with the following **amended** paragraph [0007]:

To achieve the foregoing and other objects and in accordance with the purpose of the present invention, an apparatus and method for forming a layer of underfill adhesive on an integrated circuit in wafer form is disclosed. In one embodiment, the layer of underfill adhesive is disposed and partially cured on the active surface of the wafer. Once the underfill adhesive has **been partially** cured, the wafer is singulated. The individual integrated circuits or die are then mounted onto a substrate such as a printed circuit board. When the solder balls of the integrated circuit are reflowed to form joints with corresponding contact pads on the substrate, the underfill adhesive is completely cured. In an alternative embodiment, the underfill adhesive is fully cured after it is disposed onto the active surface of the wafer. In various other embodiments, the underflow adhesive is disposed onto the wafer using stencil printing, screen printing, molding, or a spin on deposition process. The underflow adhesive is selected from a group of materials including, but not limited to, epoxies, poly-imides, or silicone-polyimides copolymers and includes one or more of the following components: epoxy resin, a hardener, a catalyst initiator, a coloring dye and an inorganic filler.

Please **replace** original paragraph [0011] with the following **amended** paragraph [0011]:

In the initial step as illustrated in Figure 2(a), a number of underbump metallization pads 110 are formed on the surface of the die 102. The underbump metallization pads 110 may be formed by a number of conventional processes. For example, a layer of solder or other conductive metal is applied on the surface of the die 102. The surface is then masked and etched, leaving the pads 110. In the next step as illustrated in Figure 2(b), solder paste islands 112 are formed on the pads 110. After the solder paste islands 112 are in place, corresponding solder balls 106 are formed by heating the wafer 100 causing the solder to reflow forming the solder balls 106. The resulting structure is illustrated in Figure 2(c). **[It is useful to note that the "bowl-like" shape underbump metallization pad 110 provides a barrier to the lateral flow of the solder paste during the reflow operation.]** The underbump metallization pad 110 also provides a barrier metal between the solder ball 106 and the interconnects within flip chip die 102.

